

Weather Note

FUNNEL CLOUDS IN HAWAII

GERALD A. PETERSEN

Weather Bureau Airport Station, Honolulu, Hawaii¹

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On the afternoon of July 7, 1960, these pilots reports were forwarded to the Weather Bureau at the Honolulu International Airport:

HNL PIREP 080314Z TORNADO 2-3 N NAHIAWA OVR ARMY RDO STN BASE 15

HNL PIREP 080319Z TORNADO VCNTY WAHIAWA DISSIPATED DARK CLOUDS VCNTY WAHIAWA

Wahiawa is located 15 mi. north-northwest of the airport. The private pilot, Mr. Allan Lloyd, who made these reports observed thick dark cumuliform clouds based at about 2,500 ft. In a detailed account of his observations, he stated:

There were tears at the base of the cloud and from one of these tears a thin thing came snaking out. It grew to about 1000 feet in length but never reached closer than about 1000 feet from the ground and it appeared to be 10 to 20 times longer than its diameter. Although very thin, a definite rotational motion was noticed but little or no whipping motion was observed. It began to fatten then shortened and appeared to disappear back into the base of the cloud lasting no more than five minutes.

Mr. Lloyd also stated that he had observed the same sort of an occurrence two or three years before in approximately the same area. At that time the weather

situation was nearly the same but with rain showers falling from the cloud from which the funnel came. In the present instance, showers were probably occurring on the Koolau mountain range 10 mi. to the east but not over or in the vicinity of Wahiawa.

A small study was undertaken to see how often funnel clouds had been observed in the past and to determine what synoptic conditions were present. It was found that in the period of record from 1948 to 1960 funnel clouds and/or waterspouts had been recorded a total of 17 times by the Honolulu district forecaster. One of these occurrences definitely was associated with a cold front and with some indications of a circulation. Damage resulted from very heavy showers and strong winds. In another case, strong local winds damaged towns on lee-ward Hawaii and Maui. In this instance, a well developed high pressure area north of the Islands pushed surface

¹ Present location, U.S. Weather Bureau, Washington, D.C.

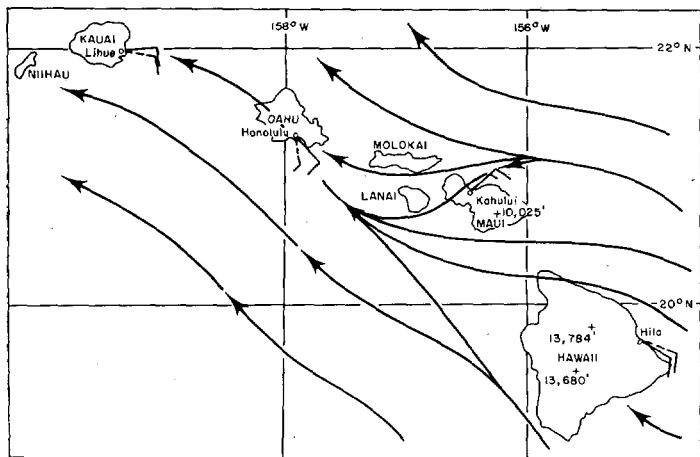


FIGURE 1.—Surface streamlines for 0000 GMT July 8, 1960. Dashed barbs indicate winds at 2,000 ft.

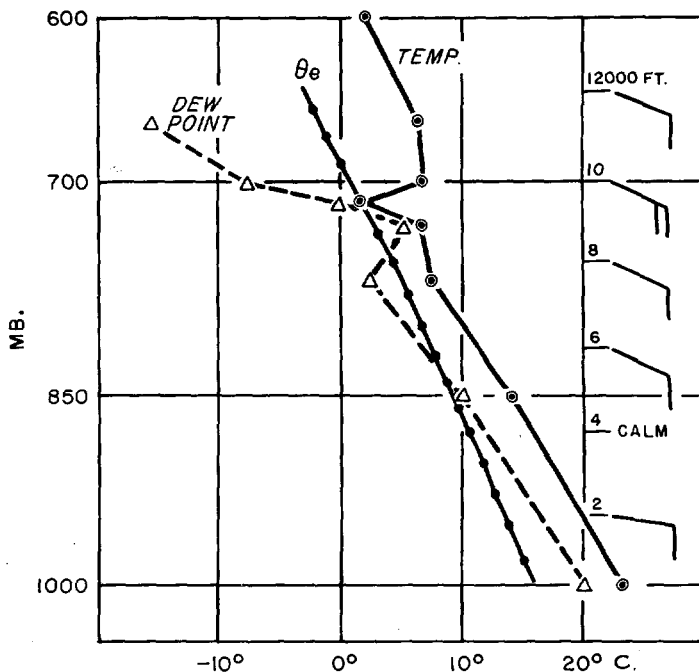


FIGURE 2.—Radiosonde sounding and winds aloft, Lihue, Kauai, 0000 GMT, July 8, 1960.

pressures up to 1025 mb. and strengthened the trades. This flow further strengthened as it funneled over the mountain barriers, where peaks reach 14,000 ft. on these islands. As the strong winds reached the ocean, tall funnels rose from the sea surface in the form of waterspouts.

In almost all other cases, the funnel clouds were observed to extend first from the base of the cloud but not to reach the surface if over land, or to begin as a "dust devil" over land and then reach upward to the cloud base. If the funnel cloud was over water, in most instances it worked its way down to the surface to become a waterspout. One exception occurred on November 23, 1954, when a thunderstorm developed off southern Oahu and moved northeastward. Three funnel clouds were observed protruding down from the base of the cumulonimbus but they did not reach the surface and lasted about 15 min.

Most of these funnel clouds developed in a situation of either light southerly or light variable winds from the surface to at least 10,000 ft.; i.e., when the Pacific High was well to the northeast and northwest of the Islands (fig. 1) or when pressure gradients supported little or no wind. In some instances, small surface Lows which may or may not have had an associated weak front or shear

line were observed to the north or in the vicinity of the Islands. In any event, the normal northeasterly trade flow was disrupted and the upper-air sounding indicated a moist-unstable layer to at least 8,000 ft. and usually to 10,000 ft. or above (fig. 2). In this situation, cumulus clouds could build to at least 10,000 ft. as all vestiges of the usual 6,000–8,000-ft. trade inversion were eliminated.

The funnel clouds which affect Hawaii appear to fall under the definition of a waterspout and are comparable to a dust devil in intensity. They can be looked for on warm humid days when the usually reliable trade wind air-conditioner has broken down and when cumulus clouds can build to 10,000 ft. or above.

[Addendum, June 11, 1962] As a matter of interest on two separate occasions, during the past six months I, as well as other members of this station's staff, have observed funnel clouds out over the water. In one instance where three funnel clouds had formed, one did reach the water to develop into a waterspout. In all other cases, they extended from the base of the clouds, lasted from 10 to 15 min., and gradually withdrew into the base of the clouds. On both days, the criteria for funnel cloud formation were met with a moist unstable lapse rate to above 8,000 ft. and a weak southeasterly gradient wind.